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ABSTRACT

Focusing on what authors can do to facilitate learning from content area textbooks, this report labels authors as "considerate," providing text that readers can understand with a minimum of cognitive effort, or as "inconsiderate," creating text that requires a conscientious, highly skilled effort if readers are to comprehend it. The discussion is organized around four text characteristics: structure, coherence, unity, and audience appropriateness. These characteristics are defined, illustrated, and related to research on their effect on comprehension and learning. Also included is a set of guidelines and a checklist for editors and authors of textbooks and for people who select and evaluate textbooks. (AEA)

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CENTER FOR THE STUDY OF READING

Reading Education Report No. 23

CONTENT AREA TEXTBOOKS

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Special Note

The text excerpts used in this paper come from several widely used textbooks. The examples are used to give "real life" verification to some text problems identified by the authors of this paper. The selection of one publisher's material over another's was quite arbitrary. The selection of examples from one textbook does not imply that other textbooks, not represented in the paper, do not contain problem prose. Rather, the intent is that the points illustrated by the examples be applied by teachers and publishers to any text materials being used, considered, or developed.

Content Area Textbooks

Why some students are not proficient in learning from content area textbooks is a question that has challenged us for several years. In seeking an answer to this question, we have proceeded along two fronts--one focused on the student and one on the text. We began with the student, investigating studying strategies that students can use to help them learn from texts. In pursuing this research, we examined many of the materials that students were being asked to study. We began to suspect that the textbooks themselves might be contributing to comprehension and learning problems since we often had difficulty finding texts suitable for teaching students the basics of studying. This difficulty prompted us to begin an investigation of texts in an effort to identify the aspects of text that seemed to impede learning.

Our research with both students and texts has been encouraging. First, we have identified some helpful studying strategies that students can be taught to use. Second, we have identified aspects of texts that can pose comprehension and learning difficulties. It is this second area that is discussed in this paper.

A fundamental premise of the discussion is that the primary purpose of content area textbooks is to provide information. We recognize that textbook authors may have other purposes, such as entertainment (in order to interest or motivate the student) and persuasion (in order to convince the student of a particular point of view). Nonetheless,

we assume that the primary aim of a textbook is to inform the student about the content area.

A second premise is that textbook authors should abide by a "cooperative principle" of text similar to Grice's (1975) "cooperative principle" of conversation. The four maxims of Grice's principle are based on the speaker's contribution to a conversation.

1. Quantity: Make your contribution as informative as required but no more informative than required.
2. Quality: Try to make your contribution one that is true.
3. Relation: Be relevant.
4. Manner: Be perspicuous, by avoiding ambiguity, obscurity of expression, and unnecessary prolixity.

In keeping with the Gricean cooperative principle, we have formulated a somewhat overlapping set of maxims that focus on the author's contribution to a text-based exchange of information. (These maxims are in some cases also implicit in rhetoric, the art of discourse.)

1. Structure: Choose a discourse structure that best conveys the informative purpose.
2. Coherence: Make the relationships among ideas clear enough so that there is a logical connection or "flow of meaning" from one idea to the next. (This rule overlaps with Grice's Manner rule.)
3. Unity: Address one purpose at a time; do not stray from the purpose by including irrelevant and distracting information. (This maxim combines Grice's "Quantity" and "Relation" rules.)

4. Audience Appropriateness: Make sure that the text fits the knowledge base of the reader. (This maxim is related to Grice's "Quantity" and "Manner" rules, and perhaps to the "Relation" rule.)

We believe that when an author follows these maxims, he or she has produced "considerate" text--text designed to enable the reader to gather appropriate information with minimal cognitive effort. "Inconsiderate" text requires the reader to put forth extra effort in order to compensate for the author's failure to have applied the maxims. Note that an inconsiderate text is not necessarily incomprehensible, but it does require more effort, skill, strategy, and prior knowledge to comprehend.

The primary purpose of this paper is to share our analytical tools for determining the relative considerateness of texts. We identify some aspects of text that can cause comprehension problems, suggest how authors might avoid those problems, and provide an instrument for evaluating the considerateness of a text.

Before we proceed, two caveats are in order. First, our suggestions are directed primarily at textbook prose. We do not address other factors affecting the quality of textbooks, such as the teachers' manuals, student activities and exercises, and graphic art. Second, our suggestions do not constitute a complete guide to writing or evaluating text. Not enough is known about reader variables, text variables, and the complexities of reader and text interactions to produce such a guide.

However, we think our concerns about structure, unity, coherence, and audience appropriateness are valid. In this paper we present research evidence about the importance of each of these characteristics and make suggestions for evaluating and writing text with respect to each one. Finally, we present a master checklist encompassing all of the suggestions.

Structure

Definition

Very simply, structure refers to the system of arrangement of ideas in text and the nature of the relationships connecting the ideas. The structure of text is determined by the author's purpose. This purpose can be thought of as a question the author is addressing. In other words, the form of text follows its function.

We have found it useful to think of the structure or form of content area text in terms of text units and text frames, terms that are defined below.

The text unit. In many disciplines authors appear to be guided by a few basic purposes or questions. Table 1 presents some of these general purposes or questions and the name of the text structure corresponding to each. Table 2 illustrates these structures. The text structures corresponding to these general purposes constitute the basic structural components or building blocks of content area text. We call these

Table 1

Types of General Author Purposes and the

Corresponding Text Structures

Examples of Author Purposes or Questions		Structure
Imperative Form	Interrogative Form	
Define A.	What is A?	Description
Describe A.	Who is A?	
List the features/ characteristics/ traits of A.	Where is A?	
Trace the development of A.	When did A occur (in relationship to other events)?	Temporal Sequences
Give the steps in A.		
Explain A.	Why did A happen?	Explanation
Explain the cause(s) of A.	How did A happen?	
Explain the effect(s) of A.	What are the causes/ reasons for/effects/ outcomes/results of A?	
Draw a conclusion about A.		
Predict what will happen to A.	What will be the effects/outcomes/ results of A?	
Hypothesize about the cause of A.		

Table 1 Continued

Imperative Form	Interrogative Form	Structure
Compare and contrast A and B. List the similarities and differences between A and B.	How are A and B alike and/or different?	Compare/contrast
Define and give examples of A.	What is A, and what are some examples of A?	Definition/Examples
Explain the development of a problem and the solution(s) to the problem.	How did A get to be a problem and what is (are) its solutions?	Problem/Solution

Table 2

Examples of Basic Text Structures

Description

The gaucho was a fierce-looking character. His hair was long and his face was bearded. The sun and wind made his skin dark and tough. His teeth gleamed white and his dark eyes shone. There was no mistaking the special clothes he wore. His narrow-brimmed felt hat was fastened under his chin with a rawhide cord. He wore a loose-fitting jacket and a scarf tied around his neck. His pants were baggy and sometimes had lace at the bottom of the legs. His wide leather belt was ornamented with silver coins kept brightly polished. On his feet were boots made from untanned skin taken from a colt's leg. The end of the boot was open so that the gaucho's toes could grasp the buttons at the end of the straps that hung from his saddle.

Fincher, E. B. In a race with time: An introduction to Latin America. New York: Macmillan, 1972, p. 245.

Table 2 Continued

Temporal Sequence

Sod houses were usually built on a slight rise or hillside to escape flooding. First, a floor space was leveled out with spades. This was wet and tamped down until solid. The next step was to cut bricks from the sod. Then the bricks were laid to make the walls. When the walls were about three feet high, simple wooden frames for the doors and windows were put in place. Finally, the roof, made with cedar beams and sod bricks, was put on.

Racing Stripes. Glenview, Ill.: Scott, Foresman & Co., 1978.

Table 2 Continued

Explanation

Action of Frost

In cold or mountainous regions, rocks are often subjected to the action of freezing water because of daily changes in the temperature. During the day, when the temperature is above the freezing point of water ($0^{o}C$), rainwater or melted snow or ice trickles into cracks in the rocks. During the night, when the temperature falls near the freezing point of water, the trapped water expands as it changes into ice.

As freezing water expands, the expanding ice pushes against the sides of the cracks with tremendous force, splitting the rocks apart. In this way, large masses of rock, especially the exposed rocks on the tops of mountains, are broken into smaller pieces. Frost often has the same effect on the paved streets of our cities. During the winter, water trapped in cracks in the pavement freezes into ice. The ice may expand enough to crack and loosen the pavement. Potholes develop from such cracks.

Contemporary Science Book 1. New York: Amsco School Publications, Inc., 1977, pp. 282-283.

Table 2 Continued

Definition-Example

Fungi

Like the algae, the fungi are simple in structure and lack roots, stems and leaves. Unlike the algae, fungi lack chlorophyll and cannot make their own food. Examples of fungi are *bacteria, yeasts, molds* and *mushrooms*.

(The text goes on to define bacteria, yeasts, molds, and mushrooms.)

Lesser, M. S. Life Science. New York: Amsco School Publications, Inc., 1967, p. 177.

Table 2 Continued

Comparison-Contrast

There is a likeness in location between the central valley of Chile and the central valley of California. These two valleys are alike in other ways. Both have thousands of acres of excellent agricultural land. Soil washed down from the mountains has, in both countries, built deep, fertile valley land. Both central valleys have a mild climate. In both, water is available for irrigation. Under these favorable circumstances, a wide variety of agricultural products can be grown. Both California and Chile are known for the table grapes, raisins, and wine produced in their vineyards. Melons, citrus fruits, and other subtropical products are widely grown. Thus the central valley of Chile, like the similar valley in California, can support a large farm population.

Even the location of cities in relation to the farmland invites comparison between Chile and California. Toward either end of the central valleys in both countries are areas where commerce and industry are highly developed. Santiago, Chile, is somewhat similar to San Francisco, California, in its location. Concepcion, Chile, is somewhat similar in location to Los Angeles, California.

Fincher, E. B. In a race with time: An introduction to Latin America. New York: Macmillan, 1972, p. 225.

Table 2 Continued

Problem-Solution

A coffee boom followed the sugar boom and the gold boom. When the Brazilians discovered that the coffee tree, a native of Africa, flourished in the red soil of the South, coffee trees were planted by the thousands. Later on, they were planted by the millions. Fortunes were made in "brown gold," as coffee was known.

But so much coffee was produced that the people of the world could not use all of it. Coffee was stored in warehouses, coffee was burned, coffee was dumped into the sea. This was done in an effort to keep the price from falling to the point where all the planters would be ruined. To make the problem yet more serious, other Latin American nations extended their coffee plantations, and African countries also began to have coffee plantations.

The Brazilian government took steps to save the situation. Planters were encouraged to destroy many of their coffee trees and grow other crops. The amount of coffee put on the market in any one year was regulated. Meanwhile, Brazil sought an agreement between the nations that exported coffee and the nations that imported it. The object was to limit the supply of coffee so that it would not be sold at too low a price.

Fincher, E. B. In a Race with Time: An Introduction to Latin America. New York: Macmillan. 1972, p. 304.

basic building blocks text units. Each text unit is typified by certain kinds of relationships, expressed as words (usually connectives) and phrases. Table 3 presents some of the words and phrases commonly associated with each text unit.

Text frame. Like the text unit, the text frame contains information that responds to a question (usually implicit). The structure of a text frame is different from that of a text unit in that the frame's structure is shaped in large part by the thinking patterns that are typical of the discipline (content area) being represented in the text. For example, biologists deal with the generic concepts of systems, structures, and processes. Sociologists work with concepts of cultures, groups, and societies. Physical geographers think in terms of climate, landforms, and geological processes. One obvious purpose of content area text authors is to communicate specific instances of the generic concepts of their discipline. For example, the author of a biology textbook who wants to inform the reader about the digestive system has as a purpose the answer to the question, "What is the digestive system?"

Each of the generic concepts of a discipline has a set of features or attributes that are typically associated with the discipline. For example, typical features of biological systems are location, component parts, and function. In communicating a specific instance of a generic

Table 3

Text Units and Commonly Associated Words and Phrases

Description		
(This text unit is often not associated with particular words and phrases. There may be mention of characteristics, properties, features, traits, and functions, but they are not specifically signalled.)		(to be) (to have) is a property of is a feature of is a characteristic of is a part of
Temporal Sequence/ Process	then, and then before after next follows earlier later finally	previously prior subsequently precedes afterwards first, second, third (dates)

Table 3 Continued

Explanation	causes	because
	affects	enables
	leads to	since
	in order to	as a result (of)
	so that	consequently
	produces	thus
	therefore	for this reason
Compare/contrast	is similar to	on the other hand
	similarly	however
	like	but
	likewise	although
	in the same way	instead
	is different from	yet
	on the one hand	while

Table 3 Continued

Definition/Examples	is defined as	for instance
	means that	type of
	is named	kind of
	is called	example of
	is labelled	e.g.
	is referred to as	such as
	that is	includes
	for example	including
Problem/Solution	the problem is . . .	
	the solution is . . .	
(This text unit is often not associated with particular words and phrases. There may be mention of problems or difficulties and their solutions or cures, but often the problems and solutions are not specifically signalled.)		

concept, then, the author responds to implicit questions about the associated features: "Where is the digestive system located?" "What are its component parts?" "What is the function of the digestive system?"

The kind of text that informs the reader about an instance of a generic concept is what we call a frame. A frame is a rather complex, content-specific text structure. It has "slots" for the associated features of the generic concept. Each slot has a purpose or question associated with it. Table 4 presents examples of some science frames identified by Lunzer, Davies, and Greene (1980). The table gives the generic name of the frame, the generic purpose of the frame, and the questions associated with the attributes or slots of the frame.

One would expect, then, that an author responding to a question such as "What is photosynthesis?" would use a Process frame. The text responding to this question would contain answers to the following questions: "What is the name of the process?" "Where is it located?" "How does the process work?" "What is the function of the process?" There may be no particular order in which the author should address these questions, but a complete answer to the question "What is photosynthesis?" should contain at least the answers to the question slots of the Process frame.

Table 4

A Listing of Several Frames and Their Corresponding Questions from Secondary Science Textbooks (adapted from Lunzer, et al. 1980)

Frame	Purpose of Frame	Question Slots in the Frame
1. Parts	To describe and explain structure or parts, for example, plant roots, teeth, nervous system.	Give the name of the part. Describe its location. Describe the part. Explain the function of the part.
2. Mechanisms	To describe and explain mechanisms such as the aneroid barometer, and the bicycle pump.	Give the name of the mechanism. Explain how it works. Explain its function. Describe its location.
3. Processes	To explain transformations over a period of time, such as the formation of limestone.	Give the name of the process. Describe when it takes place and its duration. Describe its location. Explain the function of the process.
4. Scientific Theory	To describe and explain patterns of thinking about observed phenomena in the world and tests of those patterns such as the theory of evolution and of spontaneous generation.	Give the hypothesis/question/problem. Describe the theory. Explain tests of its validity. Describe the scientist(s) who work with it. Explain applications of it.

Note that some of the question slots can be answered with a single word or phrase (give the name of the function), while other question slots require a full text unit as a response (explain how the process works). Thus, a frame is an amalgam of single-word or sentence-length responses and more extended, full-fledged text units.

The Textbook Hierarchy

A textbook is a hierarchical arrangement of text units and frames. The author begins with some very broad purposes or questions. The responses to these questions suggest other component questions. As each question gives rise to a new frame or text unit, the hierarchy expands.

Research Evidence

Structure is the text feature that has received the most attention in the research literature. From a fairly extensive body of research, we know that structure or organization influences the amount as well as the kind of knowledge acquired from reading. With respect to the amount of knowledge acquired, the conclusion is straightforward: Better organized text is better remembered. (See Goetz & Armbruster, 1980; Meyer, 1979; Pearson & Camparell, in press; and Shimmerlik, 1978.) Furthermore, information provided to the reader about the organization or structure of the text can facilitate recall (Meyer, 1979). Such information can be provided in two ways. One way is through "signalling."

Meyer (1979) has defined signalling as information in text that emphasizes certain aspects of the semantic content or points out aspects of the discourse structure. Types of signalling include: (a) explicit statements of the structure or organization, (b) preview or introductory statements, including titles, (c) summary statements, (d) pointer words and phrases, such as "an important point is . . .," and (e) textual cues such as underlining, italics, and bold face. Another means of providing information about structure is through repeated, consistent use of a particular structure. Presumably, in this way the reader learns the structure and comes to expect that ideas will be organized in that particular way.

Structure of text also affects the kind of knowledge acquired from reading by influencing the way information is stored. The better organized the text, the more highly integrated the memory representation is likely to be. Highly integrated memory representations enable learners to consider related facts simultaneously, a necessary condition for higher-order cognitive processes such as inferencing, summarizing, and decision-making (Frase, 1972; Walker & Meyer, 1980).

In sum, the better the structure of the text, the more likely the reader is to remember the information and to engage in the higher-level cognitive processes that are usually considered to be the important outcomes of a learning situation.

Guidelines Related to Structure

1. The author's topic, purpose or question, and structure should be readily apparent to the reader from titles, headings, and/or topic sentences. By simply skimming the text, the reader should be able to determine the author's specific topics, the purposes the author is addressing with respect to those topics and the structure of the ensuing text. The reader should not have to guess at the author's intention from a title, heading, and/or topic sentence.

Examples

	Poor Indication of Purpose	Improved Indication of Purpose
(a)	"What are the Chances?" [Suggests a list of probabilities consequent to a set of conditions.]	"An Explanation of Probability" [Suggests the topic and an explanation structure.]
(b)	"How fast are impulses?" [Suggests a number.]	"How do impulses travel?" [Suggests a process or explanation structure.]
(c)	"Finland is East of Sweden" [Suggests a true/false verification.]	"Finland: Climate and Geography" [Suggests a frame or descriptive structure.]
(d)	"New Genetic Types and Agriculture" [The use of "and" in this heading leaves the relationship between genetic types and agriculture vague. The author's purpose could be to describe both new genetic types and agriculture; to compare and contrast new genetic types and agriculture; or to explain some uncertain relationship between new genetic types and agriculture.]	"The Effect of New Genetic Types on Agriculture" [Suggests an explanation structure with an emphasis on effects.]

(e)	"Chicago's suburbs grew and grew."	"Chicago's suburbs grew for many reasons."
	[The author's purpose could be to give examples of suburbs that grew; to explain the causes of the growth of suburbs; or to explain the effects of the growth of Chicago's suburbs.]	[Suggests an explanation structure with an emphasis on causes.]

2. The actual structure of the text should match the author's purpose as implied by titles, headings, and topic sentences.

The following example shows a mismatch between implied purpose (to explain) and text structure (a description).

How do nerves carry signals?

Each nerve in the body is really a bundle of very fine nerve fibers. Nerve fibers are too thin to be seen except with a microscope. Each nerve fiber is part of a nerve cell.

dendrite — branch of a nerve that carries impulses to the nerve cell body

The nerve cell has a very irregular shape. It has a number of small branches sticking out, almost like the branches on a tree. These are called dendrites (den' drit). The word dendrite comes from a Greek word for "tree."

axon — a long nerve fiber that carries impulses away from the nerve cell body

At one end of the cell is a particularly long branch. It is called an axon. This axon is a single nerve fiber, as shown in the drawing.

The message that travels along the nerve cell is a small electrical charge. It usually starts at the dendrites, goes through the cell body, and then moves out along the axon. This electrical charge is called the nerve impulse.

synapse
a small gap between nerve cells

Nerve cells are strung together in chains. The branches of the axon of one cell come close to the dendrites of another cell. The parts of the different cells don't quite touch. There is a small gap between them that is called a synapse (si´naps).

The following excerpt illustrates another mismatch between title and text structure. Instead of tracing and elaborating on the decision-making process, the author chose to do something else.

The Pilgrims Decide to go to America

Finally the Pilgrim leaders said, "Why don't we go to America? Part of America is claimed by England. There we shall be able to educate our children in English ways. And we shall be able to worship in our own way."

The Pilgrims began to make plans. How could they get to America? They were hardworking and thrifty people, but they were not rich. They could not afford to buy supplies and hire a ship and crew.

The next two examples illustrate a close correspondence between titles and text structure.

What did the People do to Solve the Arguments Among the States?

In 1787, 55 representatives from 12 states met in Philadelphia. This famous meeting is called the Constitutional Convention. The representatives met to discuss rules by which the states could work together as a strong, united nation . . . The representatives went to work. They soon decided to throw out the rules made by the Continental Congress and to make up a new set of rules for the new nation . . . We call this set of rules the Constitution of the United States.

Vision Explained

Light rays coming from an object pass through the cornea, enter the pupil, and reach the lens. The lens bends the light rays, which then form an image on the retina. This image is formed in the same way that a camera lens forms an image on film. The image on the retina produces impulses that reach the brain by way of the optic nerve. When the impulse arrives at the special area of the cerebrum that controls vision, we become aware that we see something.

3. Text frames used repeatedly throughout the textbook should have a consistent structure. The reader can learn to form expectations about content and structure if frames are used consistently. An example of a text in which frames are used consistently is one which organizes information about Latin American countries in the following parallel fashion: location, history, climate and landforms, natural resources, economy, people. An example of a consistent use of a frame in a biology textbook would be one that presented information on all systems of the human body (respiratory, circulatory, etc.) in the form: general functions of the system; component parts of the system along with the process that occurs in or as a result of each part; and comparisons/contrasts of the comparable system in other organisms.

Coherence

Definition

Coherence means "a sticking together." With reference to text, coherence refers to how smoothly the ideas are woven together. In a

coherent discourse, the relationships among ideas must be clear enough so that there is a logical connection or "flow of meaning" from one idea to the next. Compared to an incoherent discourse, a coherent discourse makes it easier for the reader to perceive the message as an integrated unit.

Coherence operates at both global and local levels; that is, at the level of the whole text as well as at the level of individual sentences. At the global level, a text is coherent to the extent that it facilitates the integrations of high-level ideas across the entire discourse. Features that might contribute to global coherence include titles and visual displays or diagrams.

At the local level, features related to coherence help the reader integrate the information within and between sentences. One important local feature is connectives or phrases that function conjunctively. These include linguistic connectives that make explicit the temporal, causal, spatial, or conditional relationships between propositions (Halliday & Hasan, 1976).

Research Evidence

With respect to global coherence, the research indicates that titles can have an important effect on comprehension (Anderson, Spiro, & Anderson, 1978; Bransford & Johnson, 1972; Dansereau, Brooks, Spurlin, & Holley (1979); Schallert, 1976). In addition, visual displays,

diagrams, and charts can facilitate comprehension, presumably because of their ability to portray the "big picture" at a single glance; i.e., lend coherence to the content (Gropper, 1970; Holliday, 1975; Holliday, 1976; Holliday, Brunner, & Donais, 1977; Holliday & Harvey, 1976).

Research relating to local coherence has demonstrated that an explicit use of connectives (rather than a statement that requires the reader to infer the connective) facilitates learning (Katz & Brent, 1968; Marshall & Glock, 1978-79; Pearson, 1974-75). Other research related to local coherence has indicated that repeated references and concepts that help to carry meaning across sentence boundaries can decrease reading time and increase recall of text as an integrated unit. (See Goetz & Armbruster, 1980, for a review of this literature.)

In sum, features of text contributing to both global and local coherence appear to help readers comprehend and recall the text as a structured, integrated unit.

Guidelines Related to Coherence

1. Relationships among ideas should be explicitly stated. As discussed in Anderson, Armbruster, and Kantor (1980), the use of short, simple sentences can often obscure the meaning of relationships. Readers are then forced to infer those relationships from their own knowledge. If the reader has the relevant background knowledge, comprehension is

possible, but it requires more effort than it would if the relationships were explicitly stated. If the reader does not have the appropriate background knowledge, the intended meaning will be lost.

Examples

The following paragraph is an example of a text in which many of the connectives indicating relationships are missing and left to be inferred.

> In the evening, the light fades. Photosynthesis slows down. The amount of carbon dioxide in the air space builds up again. This buildup of carbon dioxide makes the guard cells relax. The openings are closed.

The paragraph below represents an attempt to improve the coherence of the text by making the relationships more explicit.

> What happens to these processes in the evening? The fading light of evening causes photosynthesis to slow down. Respiration, however, does not depend on light and thus continues to produce carbon dioxide. The carbon dioxide in the air spaces builds up again, which makes the guard cells relax. The relaxing of the guard cells closes the leaf openings. Consequently, the leaf openings close in the evening as photosynthesis slows down.

Here is another set of examples, with the second rewritten to improve coherence.

Many of the farmers who moved in from New England were independent farmers. Land cost about a dollar an acre. Most men could afford to set up their own farms. Livestock farming was quite common on the frontier. Hogs could be fed in the forests. The cost of raising hogs was low.

Most of the farmers who moved in from New England were independent farmers. Being an independent farmer means that the farmer can afford to own his own farm. Around 1815, most men could afford to own their own farms because land was cheap--it cost only about a dollar an acre. Many of these independent farms were livestock farms. For example, many frontier farmers raised hogs. Hog farming was common because hogs were inexpensive to keep. The cost of raising hogs was low because the farmer did not have to buy special feed for the hogs. The hogs did not need special feed because they could eat plants that grew in the surrounding forests.

2. References should be clear. The comprehension of certain words and phrases in text requires that the reader have knowledge of other ideas to which the words and phrases refer. Helping the reader keep these references straight is a prime responsibility of the author. Several types of words and phrases that require explicit referents are discussed.

Obscure pronoun references are common in textbooks. The following excerpt illustrates a confusing use of the pronoun they. The authors of this paper are still not certain whether they refers to "the people from the North" or "the Bronze Age people!"

The people from the North learned from the Bronze Age people. They were skilled workers and traders. They made fine tools and jewelry from metals. They traded their beautiful cloth and pottery to peoples around the Mediterranean. They kept records of their trade on clay tablets.

Quantifiers (for example, some, many, few) pose other potential reference problems. First, authors may omit the noun or noun phrase being quantified so that the reader has to infer it. Second, the intended quantity may be unclear, so that the reader does not have a good idea about the size of the object being referenced.

Problems with pronoun references and quantifiers are illustrated in the following excerpt. We suspect that readers may become confused when encountering four quantifiers and the pronoun they repeated seven times in this short passage.

Why Women Should Not Vote

"A woman's place is in the home!" many men said. Politics would have a bad effect on women's characters, they said. Women would soon be neglecting their homes.

Many said also that women's voting would cause arguments in the family. Arguments would weaken the family. Some believed that women were inferior to men by nature. They said that men were physically stronger and more intelligent than women. They said that women were too emotional. They were too excitable to vote wisely.

Many people attacked the women who were working for suffrage. They said that they were unattractive. They said that they were unhappily married and only wanted attention.

A definite noun phrase (e.g., "He saw the accident") without a clear referent is also a potential reference problem. The proper use of the definite noun phrase is predicated on the assumption that both the author and reader know the specific instance referred to. Thus, the sentence "He saw the accident" is unclear without prior mention of a specific accident.

A verb phrase may be the setting of another reference problem. For example, consider the following sentences. "When an Indian shot an arrow, he hardly ever missed. If he did, he might have to go to bed without his supper." It is not too difficult for an adult reader to infer that "If he did" means "If an Indian missed his target." But a young reader might not understand which preceding verb phrase is referred to by the did.

Other potential reference problems include the following:

(a) the use of also, too, etc., when the preceding cases are uncertain.

(b) the use of but, however, etc., when it is not clear what is being contrasted or qualified.

3. In temporal sequences/processes and in explanations, the order of events should proceed in one direction only. The sequencing of events should be unidirectional. The direction should generally proceed from earliest to latest in text for younger children. Young readers can become confused if the order of events in the text does not

match the order of actual occurrence. For older readers, the direction may not be so critical. However, for most purposes, it would seem that the text should remain consistent and not skip around in time. Text that changes the time frame may send the reader on a wild goose chase; the reader may be unwilling to put forth the effort to figure out the chronological or logical order behind the rhetorical order.

The following is an example of a text that changes time frame. The sentences have been numbered so that the commentary is easier to follow.

> [1]Adult female alligators make large cone-shaped nests from mud and compost. [2]The female lays from 15 to 100 eggs with leathery shells in the nest and then covers it. [3]The heat from both the sun and the decaying compost keeps the eggs warm. [4]The eggs hatch in about nine weeks. [5]Unlike other reptiles that hatch from eggs, baby alligators make sounds while they are still in the shell. [6]The mother then bites off the nest so the baby alligators can get out. [7]When first hatched, baby alligators are about 15 to 25 cm long.

Note the many shifts in the temporal sequence. The first four sentences are fine; they present the order of events from earliest to latest. The fifth sentence reverts back to when the baby alligators were still in the shell. The time frame for the sixth sentence is when the baby alligators are sufficiently mature to leave the nest. The final sentence returns to when the baby alligators were first hatched.

Incidentally, Sentences 5 and 6 are confusing for another reason. In Sentence 6, "getting out" probably refers to leaving the nest. However, since Sentence 5 left the baby alligators "still in the shell," the reader might assume that the mother alligator's biting off the nest enabled the baby alligators to "get out" of the shell.

[1]Photosynthesis in the leaves starts with the morning sunlight. [2]Carbon dioxide was made during respiration all night. [3]It was stored in the air spaces around the spongy cells. [4]This carbon dioxide is used as the leaf starts to make sugar. [5]When a certain amount has been used up, the guard cells respond. [6]They become stiff, swell out, and make openings in the leaf. [7]They stay open all day.

[8]In the evening, the light fades. [9]Photosynthesis slows down. [10]But respiration goes on. [11]The amount of carbon dioxide in the air spaces builds up again. [12]This buildup of carbon dioxide makes the guard cells relax. [13]The openings are closed.

In this example, the author has tried to grapple with the problem of describing a repetitive cycle consisting of a night phase and a day phase. The author chose to begin with the morning (Sentence 1), return to the previous night (Sentences 2 and 3), continue with the morning (Sentences 4-7), and then go on to the following night (Sentences 8-13). It would have been more considerate to begin by describing all events pertinent to the night phase in the first paragraph, and then describe the events of the day phase in the second paragraph, ending with a comment that the cycle is repeated.

It is interesting to note that only the reader who is able to connect "making sugar" with photosynthesis will know that Sentence 4 returns to the morning. Otherwise, the time frame for Sentence 4, and consequently for Sentences 5-7, is ambiguous.

Unity

Definition

Unity refers to the degree to which the text addresses a single purpose. The author of a unified text has not strayed from the purpose by including irrelevant and distracting information.

Research Evidence

A case for the importance of unity can be made more firmly on theoretical than empirical grounds. Central to the theoretical argument is the notion of a limited capacity, short-term memory that can hold only about five to nine items at once (Miller, 1956). As reading proceeds, new information must be integrated with the few propositions stored in short-term memory. The more disunified the text, the lower the probability of integration. Comprehension will probably slow down and possibly fail. Presumably, the difficulties are compounded for poor and beginning readers. In sum, text that is not well unified can theoretically create comprehension problems, particularly for less skilled readers.

Guidelines

1. Each idea in the text unit or frame should contribute directly to the fulfillment of the author's purpose. An idea that is not clearly contributing to the purpose but still merits inclusion should be indicated by using phrases such as "Incidentally, . . ." "As an aside, . . ." or "In case you were wondering about . . ." If there is a large number of irrelevant ideas, they should be edited out or they should form the basis of another text unit.

The following excerpt illustrates a text that includes information not contributing directly to the author's purpose.

The Dutch Come to America

[1]Other Europeans came to America besides the Virginia colonists and the Pilgrims. [2]The French traded and settled along the St. Lawrence River in Canada. [3]Spain had colonies in the far south. [4]Other European countries were claiming land and sending settlers, too.

[5]Dutch merchants in the Netherlands started a company. [6]They wanted to make money, too. [7]The Dutch colony sent people to the New World. [8]The people built a fort on a large island in the Hudson River. [9]They called it Fort Manhattan (man HAT n).

[10]Many Indians lived near Fort Manhattan. [11]Indians were good hunters and trappers. [12]They knew how to find wild animals in the forests. [13]When an Indian shot an arrow, he hardly ever missed. [14]If he did, he might have to go to bed without his supper.

[15]The Indians caught animals for their beautiful, soft furs. [16]The Dutch wanted the furs to sell in Europe. [17]The Dutch traded many things with the Indians. [18]Fort Manhattan became the center of the Dutch fur trade.

Apparently the author's purpose is to trace the history of Dutch settlement in America, including the establishment of the Dutch fur trade. The information about the Indians in Sentences 10-15, particularly Sentences 12, 13, and 14, does not contribute to the fulfillment of this purpose. In place of Sentences 10-16, we believe it would have been more considerate to say something like "The Indians living near Fort Manhattan were expert at hunting and trapping fur-bearing animals. The Dutch settlers wanted to obtain the beautiful, soft furs in order to sell them to Europeans who were eager to buy them." Although these two sentences are longer than others in this excerpt, we feel they are less distracting of the information-providing purpose of the author than the seven sentences they replace.

Incidentally, this excerpt also illustrates very well two guidelines related to coherence: Relationships among ideas should be clearly stated, and clear referents should be provided. The author has failed to specify the relationship between Sentences 5 and 6 and between Sentences 16 and 17. With regard to the latter, the adult reader can infer that the Dutch were trading "things" for furs, but the young reader of the text may fail to make this important inference. The author has also failed to provide clear referents for the "too" in Sentence 6 and the "Dutch colony" in Sentence 7. (We could find no prior mention of a Dutch colony. We presume the author meant the Netherlands itself rather than a colony of the Netherlands.) Also,

the object of "shot an arrow" and "missed" in Sentence 13 is missing. It may be easy to infer that the Indian was shooting at the wild animal he "knew how to find" in the preceding sentence, but it was inconsiderate not to have supplied the information.

2. Entire text units that are only slightly related to the main flow of prose in the textbook should be somehow set aside, for example, in boxed-in areas or appendices.

Examples of such text units are those that:

(a) Teach skills that are necessary for understanding a later text unit (such as reading maps or finding directions using a compass).

(b) Relate content area ideas to knowledge with which students are already familiar.

(c) Lend some authenticity to certain ideas in the text (such as excerpts from letters, diaries, notebooks, etc.).

(d) Describe the people and personalities involved in the content area.

(e) Have high interest value because of their unusual and/or attractive features (for example, including a unit about the "Venus flytrap," a plant that feeds on animals, in a chapter about animals that feed on plants).

These adjunct text units can be a valuable resource to textbook authors, who can use the units in a variety of ways to improve the textbook quality without increasing the risk of making the basic

prose more difficult to comprehend. Even when written clearly, the prose of many content area textbooks is brutally boring, and many students understandably shy away from reading them frequently or for long periods of time. The solution to the problem of how to make textbooks more enticing and fun to read lies not in the manipulation of the basic text units, but rather in the cleverness that authors/editors can use to discover and develop intrinsically motivating adjunct units.

In the following paragraph, the author's purpose (as inferred from the context) was to trace the development of events leading to the establishment of tobacco as an important cash crop in the colony of Virginia:

> The Indians grew tobacco which they smoked in pipes. Smoking was probably brought to England in the late 1500's. It quickly became popular. Historians are not sure who brought tobacco to England. Some think it was Sir Walter Raleigh. (He named Virginia in honor of Queen Elizabeth, "the Virgin Queen.")

The last three sentences do not clearly contribute to the author's purpose. The last sentence is particularly out of place. The use of parentheses helps somewhat to set the last sentence apart from the main message of the text. However, we would go a step further and recommend that the last three sentences be removed from the text or at least relegated to a box.

Incidentally, the sentence "Historians are not sure who brought tobacco to England" also violates the temporal order. The succession of events is: "Smoking was brought to England"; then, "Smoking became popular"; then back to "Smoking was brought to England" (in the form of the sentence "Historians are not sure who brought tobacco to England").

Audience Appropriateness

Definition

Audience appropriateness refers to the extent to which the text matches the reader's knowledge base--knowledge both of the content and of discourse features such as syntactic and rhetorical structures.

In order to convey an idea of how sensitivity to different audiences is reflected in text, we have included the following examples of two treatments of the same topic, appropriate for different audiences. The texts differ with respect to concepts, vocabulary, and syntactic structure.

This is the text intended for sixth graders:

A Look Inside a Leaf

Suppose you magnified a small square patch of a green leaf. The top surface of a leaf is made up of a thin layer of tough cells. These cells protect the softer cells inside the leaf. This is what your own skin cells do. The tough ones on top protect the cells deeper down inside you. Beneath the tough

surface cells in the leaf is a layer of long cells. These long cells have a rich supply of chlorophyll. It is the substance that makes green plants green.

When you pick up a leaf and look at it, all parts of the leaf seem to be equally green. But suppose you looked at a thin slice under a microscope. You would see that most of the chlorophyll is sandwiched in the middle layers of the leaf.

Just below the layer of long cells is a loose layer of cells. These cells also have lots of chlorophyll. Notice the air spaces among these loosely-packed cells. They make this layer look like a sponge. So they are called spongy cells.

If you followed one of the air passageways, you would see that it leads to an opening in the lower layer of tough cells. These openings let gases from the air get inside the leaf. And they let gases made by the green cells flow out of the leaf.

Elementary Science 6. Lexington, Mass.: Ginn & Company, 1980.

This is a text intended for older readers:

Structure of the Leaf

A microscopic examination of a leaf cut crosswise reveals five major regions: upper epidermis, lower epidermis, veins, palisade region, and spongy region.

1. Upper epidermis. The upper epidermis of the leaf consists of a single layer of cells. These cells secrete a waxy protective coating.

2. Lower epidermis. Except for the many pairs of guard cells, the cells of the lower epidermis are much like those of the upper epidermis. A stomate, or pore, lies between each pair of guard cells. The guard cells regulate the size of the pore.

3. Veins. Veins are composed mainly of xylem and phloem tubes, which are connected to the xylem and phloem of the stem and root.

4. Palisade region. The palisade region, which lies just below the upper epidermis, consists of one or more layers of elongated, boxlike cells. Each cell contains numerous chloroplasts, the bodies that bear chlorophyl. Most of the food of a plant is made in the palisade region.

5. Spongy region. The spongy region lies between the palisade layer and the lower epidermis. The cells of the spongy region are somewhat rounded and loosely arranged. These cells also contain chloroplasts and carry on some food-making. Large air spaces are scattered among the cells. The air spaces lead to the stomates.

Research Evidence

The research most directly related to audience appropriateness has been concerned with the effect of prior content knowledge on comprehension. It is quite clear from the literature that possession of relevant topic knowledge prior to reading strongly affects comprehension (e.g., Anderson, Reynolds, Schallert, & Goetz, 1977; Spillich, Vesonder, Chiesi, & Voss, 1979).

Another line of research related to the effect of prior knowledge on comprehension has focused on vocabulary, or word knowledge. In their review, Anderson and Freebody (1979) conclude from many studies that "word knowledge is strongly related to reading comprehension." A

considerable body of research on readability also supports the pre-eminent role of word knowledge in reading comprehension (see Klare, 1974-75 for a review).

In sum, the degree of the match between the text and the reader's knowledge appears to have strong effects on the comprehensibility of the text.

Guidelines

1. Taking into account the prior knowledge of the readers, enough relevant ideas should be included in the text to form a complete answer to the author's purpose or question.

The following is an example of a text in which there is not enough information to enable a young reader to form a complete answer to the question implied by the title.

How Blood is Transported Through the Body

> The numerous arteries that branch off the aorta carry blood to various organs and systems. Then veins return the blood to the heart. Among these pathways are those to the digestive organs, the limbs, the head, the kidneys, and the walls of the heart.

The next paragraph gives a fuller, more considerate explication of the process:

How Blood is Transported Through the Body

Blood is transported by the circulatory system, which is composed of a network of tubes (arteries, veins, and capillaries), a pump (the heart), and a fluid (blood) which moves. The heart pumps the blood by a series of contractions and expansions from its chambers into the arteries. Arteries take blood to all organs of the body (brain, muscles, kidney, etc.) except the lungs. Blood enters an organ from the artery through capillaries or tiny tubes. Blood also exits the organ through capillaries which are connected to veins. Veins then conduct the blood back to the heart.

Here is another example of what we consider to be an incomplete text from a chapter entitled "The Water Cycle" in a fourth-grade science textbook.

A Change of Phase

Solids, liquids, and gases are phases, or forms of matter. Matter sometimes changes from one phase to another. Some matter can again change to the phase in which it first was. When this happens, matter changes phases in a cycle.

(An investigation involving the observation of condensation follows.)

Water Comes Out of Air

Water changes phases in a cycle. In one part of the cycle, water comes out of air. It condenses, or changes from a gas to a liquid. Many things make water condense.

Look at each of these pictures. (The accompanying three pictures are of a glass of ice water, a girl with mouth partially open, and a storm.) Look for evidence that water has changed from a gas to a liquid.

Why do you think that the water condensed?

1. Why do windows in your home sometimes steam up?
2. What can make a city by the sea foggy?

Water Goes Into Air

In one part of the water cycle, water condenses. It comes out of air. In the other part of the cycle, water goes into the air. It evaporates, or changes from a liquid to a gas. Many things make water evaporate.

Look at each of these pictures. (The accompanying three pictures are of waves breaking on a beach, steam coming from a teakettle, and haze or fog along a road.) Look for evidence that water has changed from a liquid to a gas.

Why did the water evaporate?

1. What do you think makes it humid on hot days?
2. What happens when wet clothes dry?

From the title, it would seem that the author's purpose is to inform the reader about the "water cycle" frame. Component purposes are to explain the processes of condensation and evaporation. However, the text does not provide enough information to fulfill these purposes. In fact, the author does little more than restate his/her own questions, leaving it up to the fourth-grade readers to somehow inform themselves.

The following example from a social studies textbook also suffers from incompleteness.

It took the invaders a long time to develop civilizations. They were much farther away than Greece from the old civilizations of the Fertile Crescent.

Another reason was the land of Italy. A chain of mountains runs along the peninsula. On the eastern side, these mountains are rough and steep. There were no good harbors along the east coast. Few ships visited this coast.

The first paragraph needs to be expanded so that the relationship between time to develop civilizations and distance from existing civilizations is clarified. The second paragraph needs to be expanded to explain how and why the particular landforms of Italy retarded its development. The connection between landforms and development of civilizations is probably not apparent to the young readers of this textbook.

2. Technical terms or other difficult vocabulary words should be introduced only if the learning of their meaning is an intrinsic part of learning the content. When such vocabulary is required, clear definitions should be provided.

In the following excerpt, the term "vocational" is introduced in the title, but never defined. Although some students might infer the meaning from the many examples provided in the text, there seems to be no justification for simply introducing and not defining the technical term "vocational."

What Vocational School Training is Available?

Chicago has other special schools, too. Here girls and boys learn to do many kinds of work. There are classes to learn about cars and airplanes. Other classes teach about building houses. Some teach furniture making or shoe repair. There are classes that teach how to make clothes and cook. Many boys and girls learn to work in offices. Some learn to work in beauty shops. Most of these students will have good jobs someday.

In the following example, the technical term "responds to stimuli" is not defined and is not likely to be understood by the very young reader.

What is a Cell Like?

A cell is made of living stuff. It can grow. It takes in food and changes the food into more living stuff. A cell combines food and oxygen to make energy for all the things it does. The living stuff in a cell responds to stimuli. It moves.

The next example illustrates a considerate use of a definition in text. Note how and where the concept of relief is defined.

A plateau is an area of horizontal rock layers that has high relief. Relief is simply the difference between the highest and lowest points of a region. There is no fixed amount of relief for a plateau. As a rule, however, a plateau's relief is 1000 meters or more. Its high points may be well over 1000 meters above sea level. Its low points are the bottoms of its canyons and steep river valleys.

3. Analogies, metaphors, and other types of figurative language should be used only if their referents are well known by the reader.

Only familiar concepts can serve as referents for figurative language when the purpose of using the figurative language is to teach students about an unfamiliar concept. Otherwise, the student is left with the difficult task of comparing one unknown, the referent, with yet another unknown, the concept to be learned.

The statement that "haciendas are very similar to plantations in the southern part of the United States before the Civil War" will have no meaning to readers unfamiliar with the characteristics of antebellum Southern plantations. A potential comprehension problem is circumvented if the author presents a full comparison/contrast of the features of haciendas and antebellum Southern plantations. However, if the author's intent was to describe haciendas, there is no need to introduce southern plantations at all.

An example of an analogy or model used appropriately is found in a sixth-grade science textbook. The text is attempting to teach the concepts of repulsion, attraction, and static electricity. The students have just completed an exercise in which they (a) rubbed one balloon all over with wool and held it up to a wall, and (b) rubbed two balloons all over the wool, dangled the balloons from strings, and brought the balloons close together.

Have you ever played with bar magnets? If you have, you know that the two like poles of magnets push each other away. This is called repulsion. When the two unlike poles of magnets are brought together, they move toward each other. This is called attraction.

repulsion
the act of repelling or pushing away

attraction
the act of attracting or pulling toward

In a way, the balloons you used acted as if they were bar magnets. You saw attraction and repulsion. The first balloon clung to the wall, as if the balloon and the wall were unlike poles of two magnets. In the second case, the two balloons repelled each other. They acted as if they were the like poles of two magnets.

But we should not confuse balloons with magnets. Balloons are not magnetized when they are rubbed with wool cloth. But some force must be at work. Some force had to hold the balloon to the wall, and some force had to cause the two balloons to repel each other. The force at work was static electricity.

Textbook Evaluation Checklist

The checklist presented in this section is an extension of the preceding ideas. The checklist represents an attempt to formalize some of the techniques of analysis that we have been using. At this stage in its development, the checklist is not an objective method of evaluating text; at best it helps the evaluator systematize his/her subjective judgments about text quality. We hope that in some way the checklist sensitizes the evaluator to some text variables that may be important in revising and editing texts and in selecting one textbook over another.

The checklist has two major purposes: (a) to determine the purpose of a text and how well it is fulfilled, and (b) to determine how considerate the passage is.

The parts are arranged in a hierarchy to maximize the efficiency of the evaluation. Progress through the checklist depends on the successful completion of a previous part. Thus, if a text sample fails the test of the first part of the evaluation, the analysis is terminated. In other words, if the text sample does not address relevant questions and contain adequate answers, there is no point in doing a more detailed analysis of the considerateness of the prose.

Steps to Evaluate the Considerateness of a Textbook

Step 1: Select three passages from the textbook that you intend to evaluate. Do NOT read the passages carefully during this selection process. Each passage that you select should:

(a) have a title or heading,

(b) be two or more paragraphs long,

(c) have about 150 to 400 words,

(d) cover content material that is important for students to learn,

(e) cover content material you are familiar with,

(f) not make reference to charts, figures, maps, and tables.

Step 2: Formulate a question or questions based on information found in the heading or title only, that you think will be answered in

the remainder of the passage. (That is why it was important not to have read the passages carefully already.) Write those questions on the response form (see pp. 55-57).

(a) Decide whether the passage is a text unit (in which case you should have one main question) or a text frame (in which case you will probably have several questions that are all related to the content area being described).

(b) When the title or heading is very general (i.e., sport cars, green plants, wagon trains), first assume that the author is using a frame (see pp. 389-395 in an earlier section for information about frames). Try to anticipate the slots in the frame that the author will address, and write a question responding to each slot.

(c) If you are unable to determine which slots should appear in a frame, look elsewhere in the textbook and see what frame the author used for a similar concept. For example, if you are puzzled about wagon trains, see what the author does with steamboats or freight trains.

(d) If you are unable to determine which slots may be in a frame, consider the possibility that the passage will contain one or a few text units. In that case, try to guess what they might be. For example, the title "Eiffel Tower" might not readily suggest a frame, but it is reasonable to suspect that these two text units will be covered in the passage: Why was it built? How was it built?

Step 3: Read the passage carefully and underline the parts of it that are necessary to answer the questions formulated in Step 2. Also,

draw a light line through those ideas that do not contribute directly to an answer. If the passage does not provide enough information for an accurate, complete answer to the questions, does the passage answer other questions better? If so, record those questions that correspond to other text units or frames. Then, start Step 3 again.

Step 4: Decide whether or not this passage meets the two most important characteristics of informative text, i.e., the passage provided a complete, accurate answer(s) to an explicit question(s). If the answer is YES, then continue with the next step, if NO, start again on Step 1 with another passage.

Step 5: Determine how clearly the author develops the structure of each paragraph.

(a) First, determine what predominant structure you think the author intended for the paragraph.

(b) Then, locate that type of paragraph from the list below, and answer the questions under each paragraph type.

(c) Your answer will be entered on a rating scale. The 5-point scale ranges from low to high. If you are working with other evaluators, you may want to set some standards for these scales. If you are working alone, set your own standard and be consistent as you go from passage to passage and from textbook to textbook.

Paragraph Types

1. A descriptive paragraph, or frame paragraph
   (a) How clearly presented are the primary, distinguishing features, traits, and/or characteristics?

(b) How well does the author explain the relationship(s) among these features, traits, and characteristics?

2. A temporal sequence paragraph

(a) How effective are the time markers for establishing the temporal order of the events?

3. An explanatory paragraph

(a) How effective are the time markers for establishing the temporal and/or logical order of the events?

(b) How clear does the author make the relationship between each pair of events? Are they temporal, causal, and/or enabling relationships?

4. A compare/contrast paragraph

(a) How clear is the author about which two or more ideas are being compared?

(b) How clearly stated are the characteristics, traits, and features shared by the two or more ideas being compared?

(c) How clearly stated are the unique characteristics, traits, and features of the two or more ideas being contrasted?

5. A definition/example paragraph

(a) To what extent does the definition give the most important and distinguishing characteristics, features, and traits?

(b) To what extent are the examples illustrative of the idea being defined?

(c) How relevant are the examples to the readers' world knowledge?

6. A problem/solution paragraph

   (a) How clearly presented and described are the ideas that constitute the "problem"?

   (b) How clearly presented and described are the ideas that constitute the "causes"?

   (c) How clearly presented and described are the ideas that constitute the "solution(s)"?

   (d) To what extent is evidence presented that indicates whether the solution was tried or not, and whether it solved the problem or not?

Step 6: Determine how coherent this passage is.

(a) To what extent are the connectives made explicit? Investigate the gaps between the sentences, and if a connective is not used determine whether or not the use of one would help clarify the intended meaning.

(b) How effectively does the author use connectives? Search through the passage and draw a box around the connectives (and, but, also, thus, therefore, because, etc.). How many connectives can you locate? Then search for the ideas that are being connected. Can you find them? Are the ideas being connected properly?

(c) How clearly are the pronouns referenced? Search through the passage and locate all of the pronouns. Circle each one, and then search for its referent (the word(s) in the passage that the pronoun stands for). If there are two or more cases where there is some confusion about the referents, the rating ought to be low.

(d) How clearly referenced are certain nouns, noun phrases, and other phrases that require referents? Search through the passage and locate all other words, besides pronouns, that require a referent in order to be understood. If there are two or more cases where there is some confusion about the referents, then the rating ought to be low.

(e) In those cases where it applies, how consistent is the temporal ordering of events? Are the events that are temporally related arranged in either an ascending or a descending order?

Step 7: Determine to what extent the ideas in the passage contribute to a single text unit or frame. Count the total number of words in the passage, and divide that number into the number of words that fail to contribute to that single text unit or frame. This latter number can be obtained by counting the words that have a light line drawn through them (see Step 3). If more than 1/4 of the words fail to contribute to the text unit or frame, then unity suffers and the rating should be low.

Step 8: Determine how appropriate the text is to the audience.

(a) To what extent are the words in the passage likely to be understood by the readers? Locate the hard words, including technical terms, that you think readers probably will not know when they first read the passage. Place a check mark by them. Also, look for easy words that may be used in unusual ways. Then determine whether the use of each word is necessary to advance the purpose of the passage: If it is necessary, is it defined in a previous or nearby section of text? If more than two words are used unnecessarily or are not properly defined, the rating should be low.

(b) To what extent are the analogies, metaphors, and other figurative uses of language made clear by the author? Check to see if this figurative language references knowledge that the students are likely to know. Also check to see if the figurative language is signalled so that the students will realize that it is to be interpreted metaphorically rather than literally.

TEXTBOOK EVALUATION RESPONSE FORM

Textbook Title _____

Publisher _____ Grade Level _____ Copyright Date _____

Step 1: Title or heading of passage _____

Page number _____

Step 2: Is this passage a text unit ___, or a text frame ___?
Questions related to the unit or frame:

1.

2.

3.

4.

Step 3: After reading the passage carefully, is it primarily a text unit ___, or a text frame ___?
Questions related to the unit or frame:

1.

2.

3.

4.

Step 4: Does the passage have adequate answers to relevant questions?

Yes Maybe No (circle one)

Comments:

If YES or MAYBE, continue on to Step 5.

If NO, return to Step 1 with another passage.

Step 5: Write the name of the structure used in each paragraph, and then rate that paragraph using the appropriate questions (pp. 50-52).

Paragraph Number	Paragraph Structure	Question Number	Rating Scale Low				High
1	_____	1	1	2	3	4	5
		2	1	2	3	4	5
		3	1	2	3	4	5
		4	1	2	3	4	5
2	_____	1	1	2	3	4	5
		2	1	2	3	4	5
		3	1	2	3	4	5
		4	1	2	3	4	5
3	_____	1	1	2	3	4	5
		2	1	2	3	4	5
		3	1	2	3	4	5
		4	1	2	3	4	5
4	_____	1	1	2	3	4	5
		2	1	2	3	4	5
		3	1	2	3	4	5
		4	1	2	3	4	5
5	_____	1	1	2	3	4	5
		2	1	2	3	4	5
		3	1	2	3	4	5
		4	1	2	3	4	5

			Low				High
Step 6:	Determine how coherent the passage is.						
a.	To what extent are the connectives made explicit?		1	2	3	4	5
b.	How effectively does the author use connectives? (How many were used? ____)	NA	1	2	3	4	5
c.	How clearly are the pronouns referenced?	NA	1	2	3	4	5
d.	How clearly referenced are certain nouns, noun phrases, and other phrases that require referents?	NA	1	2	3	4	5
e.	In those cases where it applies, how consistent is the temporal ordering of events?	NA	1	2	3	4	5
Step 7:	Determine to what extent the passage addresses a single purpose. The computed proportion is __.____.		1	2	3	4	5
Step 8:	Determine how appropriate the text is to the audience.						
a.	To what extent are the words in the passage likely to be understood by the readers?		1	2	3	4	5
b.	To what extent are the analogies, metaphors, and other figurative language made clear by the author?	NA	1	2	3	4	5
Step 9:	Refer back to Step 2 and decide how difficult it was to formulate questions based on the title.		1	2	3	4	5
Step 10:	Refer back to Steps 2 and 3 and determine how consistent your decisions were on the two steps. If you had to formulate an entirely new set of questions after reading the passage carefully, rate this step low.		1	2	3	4	5

Conclusion

The focus of this paper has been on what authors can do to facilitate learning from content area textbooks. We suggested that authors may be "considerate" to their readers and provide text that can be read and understood with a minimum of cognitive effort. On the other hand, authors may be "inconsiderate" by creating text that requires a conscientious, highly skilled effort if readers are to comprehend it.

We organized our discussion around four text characteristics: structure, coherence, unity, and audience appropriateness. We defined and illustrated these characteristics and cited research relevant to their effect on comprehension and learning. We also included a set of guidelines and a checklist that might be helpful to editors and authors of textbooks and to people who select and evaluate textbooks.

We believe that the guidelines we offered for evaluating and writing text units and frames will help ensure that text is well structured, has coherence and unity, and is appropriate for its audience. Textbooks based on these guidelines, we believe, will be easily read and understood by students. We think that learning will increase both quantitatively and qualitatively and that this learning will occur without the heavy use of studying strategies. We think that such a textbook may help the teacher work with the textbook rather than around it; the teacher can use class time supplementing the textbook rather than translating or interpreting it. Finally, we believe that when learning from textbooks becomes easier, students will develop a more positive and receptive attitude toward the discipline.

References

Anderson, R. C., & Freebody, P. Vocabulary knowledge and reading (Reading Education Report No. 11). Urbana: University of Illinois, Center for the Study of Reading, August 1979. (ERIC Document Reproduction Service No. ED 177 470)

Anderson, R. C., Reynolds, R. E., Schallert, D. L., & Goetz, E. T. Frameworks for comprehending discourse. American Educational Research Journal, 1977, 14, 367-381.

Anderson, R. C., Spiro, R. J., & Anderson, M. C. Schemata as scaffolding for the representation of information in discourse. American Educational Research Journal, 1978, 15, 433-440.

Anderson, T. H., Armbruster, B. B., & Kantor, R. N. How clearly written are children's textbooks? Or, of bladderworts and alfa (Reading Education Report No. 16). Urbana: University of Illinois, Center for the Study of Reading, August 1980. (ERIC Document Reproduction Service No. ED 192 275)

Bransford, J. D., & Johnson, M. K. Contextual prerequisites for understanding: Some investigations of comprehension and recall. Journal of Verbal Learning and Verbal Behavior, 1972, 11, 717-726.

Dansereau, D. F., Brooks, L. W., Spurlin, J. E., & Holley, C. D. Headings and outlines as processing aids for scientific text. Manuscript submitted for publication, 1979.

Frase, L. T. Maintenance and control in the acquisition of knowledge from written materials. In J. B. Carroll & R. O. Freedle (Eds.), Language comprehension and the acquisition of knowledge. Washington, D.C.: Winston, 1972.

Goetz, E., & Armbruster, B. Psychological correlates of text structure. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.), Theoretical issues in reading comprehension. Hillsdale, N.J.: Erlbaum, 1980.

Grice, H. P. Logic and conversation. In P. Cole & J. L. Morgan (Eds.), Syntax and semantics (Vol. 3): Speech acts. New York: Academic Press, 1975.

Gropper, G. L. The design of stimulus materials in response-oriented programs. AV Communications Review, 1970, 18, 129-159.

Halliday, M. A. K., & Hasan, R. Cohesion in English. London: Longman, 1976.

Holliday, W. G. The effects of verbal and adjunct pictorial-verbal information in science instruction. Journal of Research in Science Teaching, 1975, 12, 77-83.

Holliday, W. G. Teaching verbal chains using flow diagrams and texts. AV Communications Review, 1976, 24, 63-78.

Holliday, W. G., Brunner, L. L., & Donais, E. L. Differential cognitive and affective responses to flow diagrams in science. Journal of Research in Science Teaching, 1977, 14, 129-138.

Holliday, W. G., & Harvey, D. A. Adjunct labeled drawings in teaching physics to junior high school students. Journal of Research in Science Teaching, 1976, 13, 37-43.

Katz, E., & Brent, S. Understanding connections. Journal of Verbal Learning and Verbal Behavior, 1968, 7, 501-509.

Klare, G. R. Assessing readability. Reading Research Quarterly, 1974-75, 10, 62-102.

Lunzer, E., Davies, F., & Greene, T. Reading for learning in science (Schools Council Project Report). Nottingham, England: University of Nottingham, School of Education, 1980.

Marshall, N., & Glock, M. D. Comprehension of connected discourse: A study into the relationship between the structure of text and information recalled. Reading Research Quarterly, 1978-79, 16, 10-56.

Meyer, B. J. F. A selected review and discussion of basic research on prose comprehension (Prose Learning Series: Research Report No. 4). Tempe: Arizona State University, Department of Educational Psychology, Spring 1979.

Miller, G. A. The magical number seven, plus or minus two: Some limits on our capacity for processing information. Psychological Review, 1956, 63, 81-97.

Pearson, P. D. The effects of grammatical complexity on children's comprehension, recall, and conception of certain semantic relations. Reading Research Quarterly, 1974-75, 10, 155-192.

Pearson, P. D., & Camparell, K. B. The comprehension of text structures. In J. Guthrie (Ed.), Reading comprehension and education, in press.

Schallert, D. L. Improving memory for prose: The relationship between depth of processing and context. Journal of Verbal Learning and Verbal Behavior, 1976. 15, 621-632.

Shimmerlik, S. M. Organization theory and memory for prose: A review of the literature. Review of Educational Research, 1978, 48, 103-120.

Spilich, G. J., Vesonder, G. T., Chiesi, H. L., & Voss, J. F. Text processing of domain-related information for individuals with high and low domain knowledge. Journal of Verbal Learning and Verbal Behavior, 1979, 18, 275-290.

Walker, C. H., & Meyer, B. J. F. Integrating information from text: An evaluation of current theories. Review of Educational Research, 1980, 50, 421-437.

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